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Page 3, paragraph starting at line 26:

In accordance with an aspect of the principles of the present invention, a switch matrix comprises a plurality of row conductors, a plurality of column conductors; and a plurality of switching elements adapted to connect at least one of the plurality of row conductors to at least one of the plurality of column conductors, [T]the total number of switching elements of the plurality of switching elements exceeds a product of a total number of row conductors of the plurality of row conductors and a total number of column conductors of the plurality of column conductors.

Page 4, paragraph starting at line 12:

In accordance with the principles of the present invention, a method of scanning a switch matrix comprises, driving one at a time at least one of a plurality of row conductors with a predetermined voltage level[.], monitoring each of a plurality of column conductors while one of the plurality of row conductors is being driven with the predetermined voltage level, driving one at a time at least one of a plurality of column conductors with a predetermined voltage level, and monitoring each of a plurality of row conductors while one of the plurality of column conductors is being driven with the predetermined voltage level.

Page 7, paragraph starting at line 15:

For example, assume that the push button **K5** (and no other push button at the same time) is pressed. The scanning algorithm would first drive **Row 1** Low (and drive **Rows 2** and **3** HIGH or high impedance (i.e., tri-stated output), and check the voltage levels of each of columns **Col. 1 – Col. 3**, one column at a time. Because the push buttons **K1-K3** were not pressed, a high voltage level, e.g., VDD, or a high impedance voltage level would be detected at each of columns **Col. 1 – Col. 3**.

Page 14, paragraph starting at line 18:

In contrast to a conventional switch matrix, the switch matrix of the present invention may be scanned by applying a level voltage, e.g., level LOW voltage and level High Impedance voltage, no AC noise signal may be present in the conductors **31** and **32**. Thus, although the embodiments of Figs. 4 and 5 show optional EMI capacitors **39** for protection against electro-static discharge (ESD) damages, the capacitors **39** are not necessary for [.]proper operation of the switch matrices shown in Figs. 4 and 5. Thus, the present invention provides switch matrices that can be properly scanned without the need for A[c]C coupling capacitors.

Page 16, paragraph starting at line 8:

The forward or reverse signal [**FOR/REV**] $\overline{\text{FOR/REV}}$ together with the selection signals is used to select which driver **37** is to be enabled, and also supplies LOW signal to the input of drivers **37**. The OR-Gates **13** ensure that the row drivers **37** are enabled only when both [**FOR/REV**] $\overline{\text{FOR/REV}}$ signal and the respective selection signal are low, and that the column drivers **37** are enabled only when the inverse of [**FOR/REV**] $\overline{\text{FOR/REV}}$ signal and the respective selection signal are both low. The inverter **11** inverts the [**FOR/REV**] $\overline{\text{FOR/REV}}$ signal to ensure that the rows or the columns are not both enabled at the same time. The truth table for the [**FOR/REV**] $\overline{\text{FOR/REV}}$ signal and the selection signals with respect to the selection of a driver to be enabled is shown in Table 1 below.

Table 1

[FOR/REV] $\overline{\text{FOR/REV}}$	**SEL (0)**	**SEL (1)**	**SEL (2)**	**Driver 37' output of**
0	0	1	1	Row 1 LOW, all other Hi-Z
0	1	0	1	Row 2 LOW, all other Hi-Z
0	1	1	0	Row 3 LOW, all other Hi-Z
1	0	1	1	Col. 1 LOW, all other Hi-Z
1	1	0	1	Col. 2 LOW, all other Hi-Z
1	1	1	0	Col. 3 LOW, all other Hi-Z

Page 17, paragraph starting at line 1:

The scanning algorithm cycles through the above sequence of signals of [**FOR/REV**] $\overline{\text{FOR/REV}}$, **SEL (0), SEL (1)** and **SEL (2)** as shown in table 1 above.

Page 18, paragraph starting at line 27:

For example, during the time periods **t1-t9**, [**FOR/REV**] $\overline{\text{FOR/REV}}$ is low, and the signal from the inverter **11** is HIGH, thus all column drivers **37** are disabled, and appear to column conductors **32** as if they are entirely absent. Thus, during the time periods **t1-t9**, a forward scan is performed, i.e., rows are driven and columns are monitored.

Page 19, paragraph starting at line 9:

Immediately following the forward scan, i.e., during time periods **t10-t18**, the scanning algorithm would produce a HIGH [**FOR/REV**] $\overline{\text{FOR/REV}}$ signal, which disables all row drivers **37** to output high impedance signal. The column drivers **37** are driven LOW, one at a time, and each of the row receivers **36** is read as shown. Because the LOW signal at the cathodes of the diodes **12**, the diode **12** is forward biased if the corresponding switching element, i.e., the corresponding one of the push buttons **KA-KI**, is closed. Thus, when one of the switching elements **KA-KI** is closed, the corresponding row receiver **36** will

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1. (Amended) A switch matrix, comprising:

at least one row conductor; [and]

at least one column conductor, wherein each of said at least one row conductor and said at least one column conductor are capable of being driven with a predetermined voltage level, and being capable of being read therefrom a voltage level [therefrom]; and

a plurality of switching elements adapted to connect said at least one row conductor to said at least one column conductor, said plurality exceeding a number obtained by multiplying together a number of said at least one row conductor and a number of said at least one column conductor.

4. (Amended) The switch matrix according to claim [2] 1, wherein:

[said] at least one of said plurality of switching elements is a temporary connection type switching element.

5. (Amended) The switch matrix according to claim [2] 1, wherein:

[said] at least one of said plurality of switching elements is a momentary switch [push button].

6. (Amended) The switch matrix according to claim [2] 1, wherein:

[said] at least one of said plurality of switching elements is a persistent connection type switching element.

8. (Amended) The switch matrix according to claim [2] 1, wherein:

said [total number of said at least one switching element] plurality is twice [said] a number obtained by multiplying together said number of said at least one row conductor and said number of said at least one column conductor.

9. (Amended) A switch matrix, comprising:

a plurality of row conductors;

a plurality of column conductors; and

a plurality of switching elements including at least one momentary push button adapted to connect at least one of said plurality of row conductors to at least one of said plurality of column conductors,

wherein a total number of switching elements of said plurality of switching elements exceeds a product of a total number of row conductors of said plurality of row conductors and a total number of column conductors of said plurality of column conductors.

14. (Amended) A switch matrix, comprising:

a plurality of row conductors;

a plurality of column conductors;

at least one momentary switching element adapted to momentarily connect at least one of said plurality of row conductors to at least one of said plurality of column conductors; and

at least one persistent switching element adapted to persistently connect at least one of said plurality of row conductors to at least one of said plurality of column conductors.

15. (Amended) The switch matrix according to claim 14, wherein:

said at least one momentary switching element [adapted to momentarily connect said at least one of said plurality of row conductors to said at least one of said plurality of column conductors is] includes at least one push button [; and said at least one switching element adapted to persistently connect said at least one of said plurality of row conductors to said at least one of said plurality of column conductors is at least one switch].

16. (Amended) A method of scanning a switch matrix, comprising:

driving one at a time each of a plurality of row conductors with a predetermined row voltage level;

monitoring each of a plurality of column conductors while one of said plurality of row conductors is being driven with said predetermined row voltage level;

driving one at a time each of [a] said plurality of column conductors with a predetermined column voltage level; and

monitoring each of [a] said plurality of row conductors while one of said plurality of column conductors is being driven with said predetermined column voltage level.

17. (Amended) The method of scanning a switch matrix in accordance with claim 16, further comprising:

detecting a closure of a first one of a plurality of switching elements based on a presence of said predetermined column voltage level during monitoring of said plurality of row conductors; and

detecting a closure of a second one of a plurality of switching elements different from said first one of said plurality of switching elements, said detection of said closure of said second one of plurality of switching element being based on a presence of said predetermined row voltage level during monitoring of said plurality of column conductors.

18. (Amended) The method of scanning a switch matrix in accordance with claim 17, wherein:

said plurality of switching elements [is] includes a [plurality of] momentary push button.

19. (Amended) The method of scanning a switch matrix in accordance with claim 17, wherein:

said plurality of switching elements [is] includes a [plurality of] persistent switch[es].

20. (Amended) The method of scanning a switch matrix in accordance with claim 17, wherein:

said plurality of switching elements [is] includes a [plurality of] momentary push button and a [plurality of switches] persistent switch.

REMARKS

Claims 1, 4-6, 8-10 and 14-20 remain pending, claims 2, 3, 7 and 11-13 being cancelled herein. Reconsideration and allowance of the above-referenced application are respectfully requested.

The Applicant thanks the Examiner for the indication that claims 3, 8 and 16-20 recite allowable subject matter. The subject matter of claim 3 is amended into claim 1, rendering claims 1, 4-6 and 8 allowable.

In the Office Action, the disclosure and claim 9 were objected to for noted informalities. The disclosure and claim 9 have been carefully reviewed, and are amended appropriately herein to correct the noted informalities. It is therefore respectfully requested that the objections now be withdrawn.

Claims 16-20 were rejected under 35 USC 112, second paragraph, as allegedly being indefinite. Claims 16-20 have been carefully reviewed and are amended appropriately herein to be more definite. Claims 16-20 are in full conformance with 35 USC 112. It is therefore respectfully requested that the rejection be withdrawn.

Claims 7, 12, 13, 15, 19 and 20 were rejected under 35 USC 112, second paragraph, as allegedly being indefinite. In particular, the Examiner presumes that the term "switch" in these claims requires a persistent type of switch.

Claims 7, 12 and 13 are cancelled herein. Claims 15, 19 and 20 do not require such a limitation be read into the simple language "switch", nor are any other claims of the application limited in such a way unless explicitly recited.

As a reference, there are of course different types of switches, e.g., a momentary switch, a persistent type of switch, etc. A momentary switch returns to its normal position when un-activated, whereas a persistent switch remains in the position in which it was placed. Any of these types of switches may be normally open or normally closed.

It is respectfully requested that the rejection be withdrawn.

Claims 1 and 2 were rejected under 35 USC 102(b) as allegedly being anticipated by U.S. Pat. No. 5,677,687 to Valdenaire ("Valdenaire"); and

claims 4-7 were rejected under 35 USC 103(a) as allegedly being obvious over Valdenaire. The Applicant respectfully traverses the rejections.

Claims 1, 2 and 4-7 are amended herein to include the subject matter of allowable claim 3. It is therefore believed that the Examiner will agree that claims 1, 2 and 4-7 are now allowable. Accordingly, it is respectfully requested that the rejections now be withdrawn.

Claims 9 and 10 were rejected under 35 USC 102(b) as allegedly being anticipated by European Patent No. 0441129 to Fuldner et al. ("Fuldner"). The Applicant respectfully traverses the rejection.

Claims 9 and 10 are amended to include the subject matter of claim 11, which is not subject to this rejection. It is therefore believed that the Examiner would agree that claims 9 and 10 are now patentable over Fuldner. It is therefore respectfully requested that the rejection be withdrawn.

Conclusion

All objections and rejections having been addressed, it is respectfully submitted that the subject application is in condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

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